Tagungsnummer
V273

Thema
Kommission I: Bodenphysik und Bodenhydrologie

Wurzel-Boden-Wechselwirkung und physikalische Prozesse in der Rhizosphäre

Autoren
N. Schultze[1], E. Kröner[2], A. Carminati[3], D. Vetterlein[1]
[1]Helmholtz-Zentrum für Umweltforschung GmbH - UFZ, Bodenphysik, Halle(Saale); [2]Universität Koblenz-Landau, Institute for Environmental Sciences, Landau; [3]Georg-August-Universität Göttingen, Division of Soil Hydrology, Göttingen

Titel
Measuring rhizosphere hydraulic properties: impact of root mucilage on soil hydraulic conductivity and water retention curve

Abstract
Roots are hypothesized to alter rhizosphere hydraulic properties by release of mucilage. This mechanism is expected to have strong implications for root water uptake under drought conditions. Direct measurement of rhizosphere hydraulic properties is hindered by the dynamic nature of the components involved; root hydraulics change with ontology; mucilage production, composition and diffusion are not constant; soil water content changes.
An experimental approach was developed which enables to simultaneously measure hydraulic conductivity and apparent water retention curve in a radial flow setup, mimicking the flow geometry around roots. The method consists of extracting water at constant suction via a suction cup, which is centrally placed in a soil filled cylinder and recording water outflow and soil matric potential. In the past, the setup was tested for homogeneous distribution of a model substance (calcium-polygalacturonic acid) frequently used to mimic the properties of root mucilage. Now the system has been applied to investigate the impact of plant root mucilage collected from white lupine. As the system allows a local placement of mucilage treated soil around the suction cup to simulate a ‘rhizosphere’ between bulk soil and suction cup, it can be set up with the limited quantity of natural plant root mucilage available from direct collection.
Quartz sand has been treated with lupine root mucilage by mixing liquid mucilage with dry sand at a concentration of 2 mg mucilage per gram soil. Treated sand has been placed as a circular layer with 3.75 mm thickness around the suction cup, which has a radius of 1.25 mm. All around this layer, the device has been filled up with untreated sand. The radius of the whole device was 25 mm. To determine soil hydraulic conductivity we inversely fitted the outflow curves and soil matric potential by solving the Richards’ equation in radial coordinates.
Water outflow curves show a significant impact of lupine mucilage on water flow rate – it slows water flow from bulk soil to suction cup. Currently modelling is in process to determine soil hydraulic conductivity and water retention curves. Decreasing hydraulic conductivities and increasing water retention due to lupine mucilage treatment are expected.